MISCELLANEOUS NOTES

1. MOVEMENT PATTERNS AND HABITAT USE OF GOLDEN JACKAL *CANIS AUREUS* IN BHAL REGION OF GUJARAT[1]

VINAYAK K. PATIL[2] AND YADAVENDRADEV V. JHALA[3]

[1]Accepted August 16, 2008
[2]College of Forestry, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, District Ratnagiri 415 712, Maharashtra, India. Email: vinjack@sify.com
[3]Wildlife Institute of India, P.B. No. 18, Chandrabani, Dehradun, 248 001, Uttarakhand, India. Email: jhalay@wii.gov.in

The Golden Jackal *Canis aureus* is the most widespread of all jackal species (Sheldon 1992). In India, the Jackal is found in high densities in parts of Gujarat, Maharashtra, Rajasthan and Haryana (Jhala and Moehlman 2004). They are relatively abundant throughout their range. Their usefulness in any ecosystem is as of scavengers and controllers of rodent populations (Sankar 1988; Moehlman 1993).

A few long-term and several short-term studies have been conducted on jackals (van Lawick Goodall and van Lawick 1971; Moehlman 1993; Sharma 1998). The Golden Jackal occupies a variety of habitats by adapting to the varied conditions. Therefore, several aspects of jackal ecology and behaviour are not fully understood. One of the generalized views is that jackals are nocturnal. This study was conducted to investigate the nature of movement patterns and allied behaviour of Golden Jackals in a predominantly agrarian ecosystem. This study, conducted during May-June 2002, was based on continuous monitoring of one radio-collared Golden Jackal.

Study Area and Animal

The study site is in the Bhal region of Gujarat, India. It falls within the Bhavnagar district. Bhal is a semiarid region (Dharmakumarsinhji 1978). Almost all the precipitation occurs during the monsoon, which begins at the end of June and continues till mid-September. October is a transition period with sporadic showers (Jhala 1997). The temperature ranges between 1 °C and 38 °C in winter, which is from November to February. During summer, i.e., March to June, the day temperature normally ranges between 37 °C and 48 °C.

The habitat in the study area comprises of four intermingled ecosystems, namely agricultural, grassland, shrubland and saline habitat. The Golden Jackal shares its habitat with the Wolf *Canis lupus pallipes*, Nilgai *Boselaphus tragocamelus*, Indian Wild Boar *Sus scrofa*, and Wild Fox *Vulpes bengalensis*. Besides, the area supports a variety of rodents (*Tatera indica*, *Millardia meltada*, *Mus booduga*), hare (*Lepus* sp.), birds and insects.

The Golden Jackal individuals had been radio-collared in the study area earlier for home range studies (Aiyadurai and Jhala 2006) as a part of the Wildlife Institute of India's project 'Conservation of the Indian Wolf'. At the start of this study, only one animal survived with an active radio-collar and provided us with good data. This Jackal, an adult male named Don, was radio-collared in December 2000.

Methods

For studying the movement pattern and habitat use, the study animal was followed continuously for two sessions of 72 hours each. The sessions started in the morning and ended at around the same time on the third day, thus covering both diurnal and nocturnal activity. According to Kenward (1987), such data can be used for determining the movement pattern and habitat use despite its limited utility for home range estimation due to the data redundancy effect. But these data give the exact minimum area, which may be a part of the animal's home range, used for that particular period of monitoring.

In this study we used the Telonics telemetry receiver, a 3-element hand held Yagi antenna and a Magellan GPS unit.

For continuous monitoring the procedure remains the same as that for obtaining single independent radio-fixes, the only difference is that the animal is not disturbed and the location is recorded only after the animal moves from that place. Neither homing-in nor triangulation can be used for obtaining exact locations. Homing-in is not used so as not to disturb the animal when it is involved in its normal activities. Triangulation takes time and is not useful when the animal is moving. So, an approximation of the location of the animal is to be made. The error introduced due to this has been discussed by Aiyadurai (2001). Other information on associated animals (whenever sighted), activity, habitat type, nearest village, nearest water source, date and time were recorded in data sheets.

For recording purposes, the habitat was divided into four categories: dense *Prosopis*, medium *Prosopis*, sparse

Prosopis and open fields. In field, visual estimation of the density of *Prosopis* patches in terms of accessibility to human beings was used to discriminate between the habitat types.

Data Analysis

The distances between successive locations were estimated by importing the location data in a GIS domain. This was facilitated by the availability of a previously generated GIS model of the study area in the ongoing project. The time spent at each location was obtained from the associated time data.

The movement data with respect to time was analysed for obtaining the rate of travel and average distance travelled per night and per 24 hours, i.e., the movement patterns. For estimating the time of day preferred for performing a certain activity, the time of day was divided into 8 periods of 3 hours each, and the time spent in each activity was estimated for each period separately.

Estimation of the habitat preference for performing a certain activity was done by sorting the radio-locations first by habitat and then by activity, and then summing the time spent for each activity in each habitat. Habitat and activity data were integrated to know which habitat was preferred for a particular activity. Since the available habitat could not be estimated, we were unable to test whether the habitats were used in relation to their availability.

Results

Movement

On an average the Jackal left its patch for foraging at 1922 hrs (range = 1704 to 2045 hrs, n = 6), and it retired to its resting patch at 0700 hrs (range = 0340 to 0905 hrs, n = 6).

The Jackal moved on an average 8.58 km per night (SE = 2.461, n = 6) and, it travelled this distance at a rate of 0.74 km per hour (SE = 0.203, n = 69 hours) (Table 1). Besides these forays in the night, the Jackal also moved from one patch to another during the daytime. Including this movement, the Jackal travelled an average distance of 9.55 km per 24 hours (SE = 2.361, n = 6). In the first session the distances travelled per 24 hours were 8.82 km, 2.83 km and 4.73 km, whereas in the second session the distance travelled was 9.28 km, 12.71 km, and 18.94 km per 24 hours.

Observations and plots of the movement tracks in the GIS domain showed that the Jackal visited the outskirts of villages regularly and systematically, i.e., from one village to the other taking a circuitous route, which took it back to its resting patch.

Table 1: Distance travelled/night by radio-collared Jackal

Night	Distance travelled/ night (km)	Time elapsed (hours)	Rate of travel (km per hours)
1	5.58	10.8	0.52
2.	1.42	11.3	0.13
3.	5.51	12.1	0.46
4.	9.08	8.2	1.11
5.	11.03	13.8	0.80
6.	18.85	13.1	1.44
Total	51.48	69.3	4.45
Average	8.58	11.6	0.74

Activity and Habitat Use

The data on activity and habitat was pooled for two sessions and the percent time spent in each habitat and percent time spent performing each activity were calculated using the time spent between two successive radio-locations. It was estimated that the Jackal spent 71% of its time resting, 24% moving and 5% feeding. Similarly, it spent 53% of its time in medium *Prosopis* thickets, 35% in dense *Prosopis* thickets, 8% in open fields, and 4% in sparse *Prosopis*.

Fig. 1 shows the percentage of time spent in different activities during different times of the day. The major activity during the daytime was resting while during night it was movement. Feeding was performed for a very short duration during the night hours, when it was actually moving in search of food.

Fig. 2 shows the percentage of time spent in different activities in different habitats. While most of the resting time was spent in the dense and medium *Prosopis* thickets, most of the moving time was spent in open fields and sparse *Prosopis* patches.

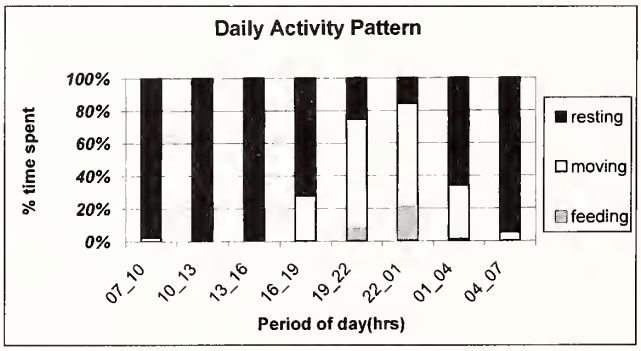

Fig. 1: Proportional time spent in different activities during different times of day by a radio-collared jackal during two sessions of 72 hours of continuous monitoring

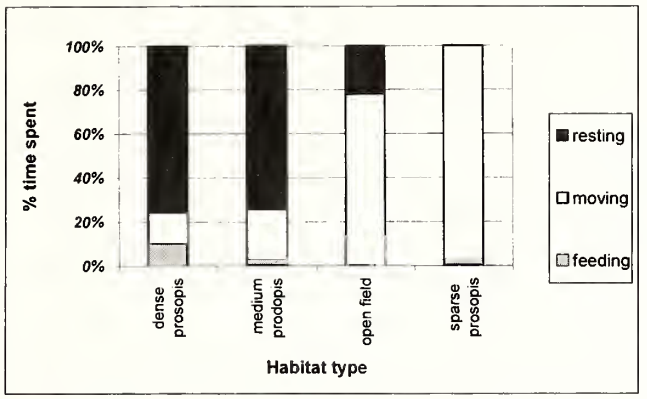

Fig. 2: Proportion of time spent in different activities at different habitats

Discussion

Since the study was conducted for a short duration based on one animal, the result cannot be generalized; but the information generated from continuous monitoring of the radio-collared animal re-confirms the popular belief of its general behaviour.

It can be clearly seen that resting is the dominant activity for the period between 0400 and 1600 hrs. Thus, this Jackal rested for almost the whole day and started moving only at dusk. Occasional movements were also recorded during the daytime, but they were mainly stimulated by the need to attend to the den or by some disturbance, which was almost always human induced.

On an average the Jackal travelled about 8.6 km every night and on an average spent 7-8 hours away from its resting patch foraging only in the night. Moehlman (1986) says that the Jackals go on forays extending up to 5 km. Aiyadurai (2001) has also reported night forays of the Jackals in Bhal to be around 6.2 km. The study animal was also observed to travel in excess of 20 km during one night. In a simultaneous study conducted in the nearby Velavadar National Park, it was observed that carcasses of domestic livestock and fawns, and adults of wild ungulates killed by wolves, featured in the Golden Jackal's diet. The area used by the radio-collared Jackal has an extremely low ungulate density (pers. obs.), and the Jackal was observed to visit the outskirts of villages searching the dumping sites for offal and carcasses of cattle. Although village dumps are abundant, carcasses are very rare. One night the Jackal was observed to systematically visit the outskirts of seven villages, but got a carcass only at one village.

The jackal preferred dense and medium *Prosopis* patches for resting, which was mainly done during daytime, as they provided excellent cover. It was observed moving mostly in open fields and sparse *Prosopis* as while foraging during nights there was no apparent need for cover. This should be the general behaviour of Jackal. The feeding habitat in the study area is generally related to the condition of the dumping sites. Thus, the habitat preference in this case seems to be related to the activity pattern.

ACKNOWLEDGEMENTS

We thank the USFWS and Earthwatch for financial support; and the Gujarat Forest Department for cooperation and facilities. The first author is also thankful to Joseph, Priya, Kartikeya, Rajinder, Ramesh and Lallu for their support during the fieldwork.

REFERENCES

Aiyadurai, A. (2001): Home Range, Ranging Patterns and Abundance Estimation of Golden Jackals in the Bhal Region of Gujarat. M.Sc. Dissertation. Saurashtra University, Rajkot. 56 pp.

Aiyadurai, A. & Y.V. Jhala (2006): Foraging and habitat use by Golden Jackals (*Canis aureus*) in the Bhal Region, Gujarat, India. *J. Bombay Nat. Hist. Soc. 103(1)*: 5-12.

Dharmakumarsinhji, K.S. (1978): Velavadar National Park, Gujarat, India. *Tigerpaper 5(1)*: 6.

Jhala, Y.V. (1997): Seasonal effects on the nutritional ecology of Blackbuck *Antelope cervicapra*. *J. Appl. Ecol. 34*: 1348-1358.

Jhala, Y.V. & P. Moehlman (2004): Golden Jackal *Canis aureus*. Pp. 156-161. *In*: Sillero-Zubiri, C., M. Hoffmann & D. MacDonald (Eds): Canids: Foxes, Wolves, Jackals and Dogs Status Survey and Conservation Action Plan. IUCN/SSC Canid Specialist Group. Gland, Switzerland.

Kenward, R. (1987): Wildlife Radio Tagging: Equipment, Field Techniques and Data Analysis, Academic Press Limited, London. 222 pp.

Moehlman, P.D. (1986): Ecology of Cooperation in Canids. Pp. 64-86. *In*: Rubenstein, D. & R. Wrangham (Eds): Ecological Aspects of Social Evolution. Princeton University Press.

Moehlman, P.D. (1993): Social Organization in Jackals *In*: Sherman, P.W. & J. Alcock (Eds): Exploring Animal Behaviour (Readings from American Scientist). Sinaeur Associates Inc., Sunderland. Pp. 209-218.

Sankar, K. (1988): Some observations on food habits of Jackals (*Canis aureus*) in Keoladeo National Park, Bharatpur, as shown by scat analysis. *J. Bombay Nat. Hist. Soc. 85(1)*: 185-186.

Sharma, I.K. (1998): Habitat preferences, feeding behaviour, adaptations and conservation of the Asiatic Jackal (*Canis aureus*) in the Indian Thar Desert. *Tigerpaper 25(4)*: 11-12.

Sheldon, J.W. (1992): Wild Dogs: The Natural History of Non-domestic Canidae. Academic Press Inc. San Diego. 248 pp.

van Lawick-Goodall, J. & H. van Lawick (1971): Innocent Killers. Collins, St. James' Place, London. 222 pp.